

A DISSERTATION
ON THE
METHOD OF RIGHTLY USING REASON,
AND
INVESTIGATING TRUTH IN SCIENCES,

TRANSLATED INTO ENGLISH
FROM THE LATIN EDITION OF THE WORKS OF

RENATUS DESCARTES.

BY
LINGAM LAKSHMAJI PUNDIT.

*Duntaxat rerum magnarum parva potest res
Exemplare dare, et vestigia notitiae.*

LUCRETIVS.

Thus things minute instruct us and unfold
The laws, at times, of things momentous most.

JOHN MASON GOOD.

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THE TRANSLATOR'S PREFACE.

ALTHOUGH I have carefully studied the philosophical works of the celebrated Descartes from the corrected Latin Edition, I have not as yet been so fortunate as to meet with an English version thereof. No eulogiums are needed from an oriental whose obligations to Western learning are immense.

According to some, the present prosperity of the European nations is due to the *Novam Organum*, the study of which has enlightened my mind, and expelled from it many a false notion; and, after having carefully studied the Method of Descartes, I have become convinced that the sound common sense which every educated European gentleman generally displays not only in his every-day life dealings, but also in the solution of every grave problem submitted to his consideration, is owing to the practical instruction which the father of philosophy's Dissertation on the Method contains, and which, presumably in some manner, forms the foundation of his general education. That being so, I can do nothing better than to present to the rising generation of orientals, an English version of

THE TRANSLATOR'S PREFACE.

the Method which will certainly serve as a practical guide to every one entering upon life, while furnishing them who have already entered upon it, and who attentively study it, such practical suggestions as will enable them to surmount the difficulties which they may encounter now and then.

I have taken pains to render the philosopher's meaning as accurately and faithfully as possible ; but whether I have succeeded in this attempt, it is for scholars to determine.

LINGAM LAKSHMAJI.

VIZAGAPATAM, }
January 1st, 1892. }

DEDICATED
TO
HIS ILLUSTRIOUS HIGHNESS,
THE
MAHARAJA OF VIZIANAGARAM, K.C.I.E.,
A
PRINCE
WHOSE

Scholarly attainments, philosophical research, encouragement and advancement of learning, philanthropy, public spirit, generosity and benefactions elicit general admiration and gratitude.

DESCARTES' METHOD.

THERE is nothing which is more equally distributed among men than right mind; for everybody supposes to possess it so abundantly that even those who have inordinate desires and—whom nature has satisfied in nothing else, are not in the habit of desiring a better mind than that which they already possess. It is not to be believed that all err equally in this matter; but the faculty of judging rightly, and distinguishing truth from falsehood,—which we properly designate as the right mind or the right reason,—is innate in an equal proportion in every one of us. It is not from the fact that some of us possess more reason than others that the diversity of our opinions proceeds; but because we do not all of us think on the same lines, or attend to the same facts. It is not enough that we have a strong intellect, but to use it rightly is what is to be chiefly desired. Although high personages are capable of great virtues, they are not less so of great vices; and they accomplish more who perpetually treading a right path only move with a steadfast pace than they who always erring yet walk with great haste.

I have never assumed that my intellect is greater than that with which everybody else is endowed; on the contrary, I have rather aspired to equal certain others in the swiftness of thinking, or in the easiness of distinctly fancying, or in the capacity and use of memory, knowing as I do that there are no other gifts by which the intellect is rendered more powerful. As to reason by which alone we are men, I readily believe that every one is endowed with an equal proportion of it; nor can we differ in this from the common opinion of the philosophers that it is *only in the accidents, not in the substantial forms of the individuals of the same species*, that the proportion is more or less.

I do not hesitate to admit, that owing to some singular good fortune I have from my youth fallen into those ways of think-

ing, by which I have arrived at the knowledge of certain rules or axioms on which is constructed this method, by the help of which, I confidently trust gradually to increase knowledge, and in the end to advance it, as, in proportion to the meagreness of my understanding and shortness of my life, may be expected, to the highest point. For I have already reaped such fruits from it, as, although I am wont to judge moderately of myself, and, while I view with a critical eye the different pursuits of men, I scarcely find any which are not either vain or useless, I cannot but say that, from the progress which I consider myself to have made in the investigation of truth, I have derived the highest satisfaction, and have conceived such hope regarding those things which yet remain to me for investigation as to believe that, if among the pursuits of those who are simply men, there is anything which is solidly good and grave, it is that which I have chosen.

It may perhaps be that my opinion is fallacious, and that what I here offer as gold and gems is merely brass and glass. I know how liable we are to error when we begin to judge of ourselves, and with what suspicion we ought to accept the testimonies of friends when they favor us. But I intend to make manifest in this pamphlet what ways I have followed in search of truth, and to delineate the whole of my life as it were in a picture, in order that everybody may have an opportunity of examining it, and that I may, from behind my own picture, listen to the free criticisms of men for my own emendation, and adopt this mode of instructing myself in other matters which I am accustomed to handle.

Let nobody think that I am going to deliver here a certain method which everybody ought to follow for the government of reason; on the other hand my object is only to explain that which I have myself followed. Those who presume to give precepts to others, shew by such a course that they are wiser than those whom they undertake to teach, and therefore their failure in the least subjects them to grave reprehension. While I here promise nothing else than the narration of a history, or if it please you better, of a summary of facts in which for several

things which it will not be useless to imitate, there will perhaps be many others which are to be avoided; I hope that it may benefit some, as it will certainly do harm to nobody, and that all may shew some favor to my plan.

From my early youth I have applied my mind to the cultivation of letters; and because I learnt from my preceptors that by the help of letters certain and clear knowledge of all those things which are useful in life could be acquired, I burned with incredible desire of learning. But as soon as I passed through that course of studies, after which it is usual to be admitted into the body of the learned, I began to think of something else. I observed myself to be involved in so many doubts, and in so many errors, that I found that all my exertions for knowledge availed me nothing more than to reveal my own ignorance more clearly.

I was then studying at one of the most celebrated academies of Europe, where, if any where on the face of the earth, I thought there ought to be learned men. With all with which others used to be imbued there I was likewise imbued. Not content with the sciences which were taught, I read as many books as fell into my hands, treating of any other subjects more profound and more removed from the vulgar. I also made myself acquainted with the judgments which others formed of me, nor did I observe anybody holding me inferior to any of my fellow students some of whom were destined to fill the places of the preceptors. And lastly, I thought that our age was not less bright and less productive of good intellects than any of the preceding ages. All these made me audacious of judging about others from my own standard, and of believing that there was in the world no other knowledge equal to that of which I formed hopes.

Nor indeed did I therefore neglect all those studies to which I had given attention in the academies; for I admit that the knowledge of languages which is acquired there is requisite for understanding the ancient authors; that the artificial narrations of the dramatic compositions polish and inspire the mind, that memorable historical events induce us to undertake great things:

and that when the study of history is prosecuted with discrimination, it assists us in no small degree in the formation of our judgment ; that all reading of good books profits us in the same way as if we were engaged in familiar conversation with the most distinguished intellects of antiquity whose monuments such books are ; and that such conversation is so premeditated that they who converse with us communicate to us only their best and most select thoughts : that eloquence has great charms ; and tends to adorn life ; that than poetry there is nothing more pleasant or sweeter ; that mathematics has ingeniously invented many things which, while they delight the curious, are helps for perfecting certain works, and for diminishing the labour of artificers ; that there are in the writings about morals many precepts, and most useful exhortations to virtue ; that theology teaches the mode of possessing heaven ; that philosophy furnishes us with the means of discussing with seeming truth regarding every thing, and excites no small admiration among more simple persons ; that jurisprudence and medicine and the remaining sciences heap honors and wealth on their cultivators ; and that there is no other science even the most superstitious and false, to which it may not be useful to devote some attention, that we may at least be able to know whether there is anything of value in it, and that we may not be easily imposed upon by it.

But I thought that I had already spent sufficient time in the study of languages, and in the study of ancient authors, and also in the reading of ancient histories and ancient dramas. What is gained with regard to antiquity by reading the books of the ancient authors is gained with regard to the present times by travel. It is essential that we should know something about the character and institutions of the peoples of the other countries, in order that we may judge more honestly of ours, and in order that we may not at once jump to the conclusion, as those who have never crossed the bounds of their native soil are wont, that what does not accord with us is ridiculous and absurd. But those who travel too long, at last appear as if they were guests and strangers in their own country ; and those who engage more than ordinarily in antiquarian studies cannot but be ignorant of

what is now passing among us. Moreover the ancient dramas represent many things that could not have possibly happened as if they had really happened at some time, and induce us to undertake things which are above us, or to desire such things as are beyond our power. The histories themselves, though true if they neither increase nor change the worth of things that they may be held more worthy to be read, omit less important and less illustrious circumstances; from this it follows that they never represent things as they really were; and those who affect to live according to their examples fall into the deliriums of ancient heroes and reflect only hyperbolical facts.

I value eloquence very highly, nor do I burn with small love for poetry; but both I regard rather as gifts of nature than as acquisitions of industry. Those who are endowed with the highest power of ratiocination and arrange their thoughts in the best possible order, so that they may be clearly and distinctly understood, are always the aptest to convince, although they only use the barbarous language of the Goths, and have learnt no rhetoric. And those who are born for excogitating the most ingenious figures, and expressing their ideas with the highest embellishment and sweetness are the greatest poets, although they are ignorant of the rules of the Poetic Art.

Mathematical doctrines delight me on account of the certainty and evidence of the calculations on which they rest; but as yet I fail to see their utility; and as they appear to be only applied to the mechanical arts, I wonder that on such firm and solid foundations, there is as yet nothing more substantial raised. And on the contrary, I compare the moral writings of the ancient non-Christian philosophers with exceedingly superb and magnificent palaces, but constructed only with mud, or on sandy foundations.

They extol virtues with the highest praises to the sky, and rightly contend that virtues should be pre-eminently preferred to everything else; but they do not satisfactorily explain to us what is to be held as virtue; and often what they dignify with so illustrious a name may rather be called vastness, and hardness, or pride, or desperation, or parricide.

I respect our theology; nor do I desire less than any body else to possess myself of eternal happiness. But holding as I do that certain and explored as the way which leads to it is, it is not more open to the learned than to the ignorant, and that the truths revealed by God exceed human capacity; I fear I shall be guilty of rashness if I am to subject them to the examination of my weak reason. And whoever venture to undertake upon themselves the office of comprehending and interpreting them, cannot do so without God's special grace; and thus they are placed above the common run of mankind.

Regarding philosophy I say nothing, except that seeing that it has been cultivated by the pre-eminent intellects of all ages, nothing has as yet been established about which arguments are not advanced on both sides, that is to say which is not dubious and uncertain; nor do I so entirely trust to my own intellect as to assert that I have discovered in it something better than others have ever done. And when I see the variety of opinions always held regarding the same thing, each of which is defended by the learned, though not more than one can be true; whatever is maintained as only probable is, I think, to be equally held as false.

As to what appertains to the other sciences, since they borrow their principles from philosophy, I believe that no sufficiently solid and firm superstructure can be raised on such an unstable foundation. Neither the glory nor the reward which they promise could induce me to cultivate them. For, as for reward, I do not think that I am in such a condition of life as would force me to convert liberal learning to illiberal use. Though I cannot say that I have despised glory as a cynic, yet I do not think much of that glory which is a misnomer when applied to that which is to be acquired by the knowledge of such sciences as are not true. And lastly, I have dipped into all, including the vainest and the falsest, and am able to guard myself against the promises of the alchymist, or the predictions of the astrologer, or the impostures of the magician, or the empty bragging of that class of professors who, wishing to appear to know that which they do not know, are yet apt to deceive.

Wherefore as soon as I was, age permitting, released from the custody of preceptors, I entirely relinquished the study of letters, and having formed a resolution of in future seeking no knowledge except that which could be found either within myself, or in the vast volume of the world, I spent some of the succeeding years in various travels, and the intervals of time, in inspecting armies, and cities and courts of foreign princes, in conversation with men of different characters and ranks, in gaining experience everywhere, in trying myself in different conditions of fortune, attending to every thing that occurred in life in order that I might omit nothing by which I might become more instructed and informed. I indeed believed that much more certainty is found in such ratiocinations as private individuals employ in their own affairs, seeing that they immediately suffer by unfavorable consequences if their calculations are wrong, than in those which a leisurely doctor sitting in his study excogitates about the entities of reason, or the like which are of little use in life, and from which he expects no other results than perhaps as much more glory as his ratiocinations are the further removed from truth and common sense; because, forsooth he must employ more ingenuity and more industry for making them appear similar to truth. I have therefore always laboured to acquire the knowledge of distinguishing truth from falsehood, that I may clearly see the right path of life and follow it with greater security.

I confess that I have scarcely learnt anything certain as long as I only thus observed the different individual characters, seeing that there are in them as many varieties as I had before seen in the opinions of the philosophers; and the only fruit from this study was that, I noted many phases, which, although they appear plainly to differ from us and to be ridiculous, are yet approved by common consent among certain other communities. I learnt that nothing should be too obstinately believed as true which only example or custom exhorts us to believe as true. And thus I have sensibly freed my mind from many errors and rendered it apter for receiving true reasons. But after I had spent a certain amount of time in inspecting what was

being done by others in the world, and gained some experience, I once proposed to myself to examine myself seriously and to see what was the best thing that I could achieve with all the energy of my intellect. Of this the result has been, as I think, more favorable than if previously I had neither withdrawn myself from my native country, nor at any time from academic studies.

II. I was then in Germany, to which curiosity of seeing the

The principal rules
of the method which
the author has in-
vented.

war which has not as yet ended had led me;

and when I returned from the Emperor's
inauguration towards the camp, I had, as it

were, by chance to winter at a certain place

where, as there were none for me to confabulate with, and as by some good fortune I was free from all cares, I spent whole days alone in a sweating room, and indulged myself in various meditations. Among other things the first which struck my mind was, that the works to which different artificers, little agreeing among themselves, had applied their hands were rarely as perfect as those which were finished by a single individual. Thus we see the buildings planned and perfected by the same architect, are generally more elegant and more symmetrical than those constructed by different architects by the addition of new walls to the old ones at different times. The capitals of ancient states, which, beginning as merely inconsiderable villages, gradually expanded, have become cities, if compared with such modern cities as were designed by a single architect, are found to be exceedingly confused and disorderly masses. Although to him who inspects single buildings in such capitals many appear to have been planned with more art and taste than others, yet if we were to view the whole at the same time and observe how the great added to the small form unequal and curved streets, they would appear rather as heaps thrown together by some blind and fortuitous occurrence than as directed by the desire of reasonable beings. If we add to this the fact that there have always been in those cities certain officers who designated as ediles are charged with the duty of seeing that private buildings contribute as much beauty as possible to the

general ornament; we shall clearly understand how difficult it is for those who only put their hands to the works of others, to make anything exactly perfect. In the same manner, it is easily seen that the communities which were formerly rude and uncivilised, and only acquired refinement gradually, nor were compelled to enact any other laws than such as were conceived on account of inconveniences resulting from crimes and discords, do not live under an equally well-ordered government as those which from the beginning of their grouping together have been under constitutions of some wise legislator. Such certainly is the state of true religion governed by laws sanctioned by God himself, and being the best constituted admits of no comparison with any other state. But to concern ourselves only with things which appertain to men; if formerly the Spartan state was most flourishing, I do not think that this prosperity was due to the fact that its laws individually considered were superior to those of any other state, because, on the contrary, many of them were unfit for general observance, and clashed with good morals; but, from their having been excoGITated by one and the same legislator, to the fact of their having been consistent with themselves, and to their having all aimed at the same end. In the same manner, I am convinced that the sciences which are contained in books, those I mean which wanting clear demonstrations, rest only on arguments apparently true, because they are made up of the various opinions of different men collected together, they do not approach truth nearer than the opinions of some single individual who, relying only on his natural reason, and free from prejudice, is able to form regarding certain visible objects. So also it is plain that as we were infants before we have been men, and have long followed the dictates of either desires or preceptors, usually clashing with each other, and neither convincing us as such as ought to be adopted, it is scarcely possible that our judgments should be as right and firm as if our reason were from our early youth as mature as it is now, and we submitted ourselves entirely to the rule of reason.

But it would be madness to demolish all the buildings of any city in order that others constructed in their stead in better

order and form might make the streets more beautiful. It is again certainly not madness in the proprietor of any single house to pull it down for the purpose of building a better one in its place ; indeed many are always forced to do this, when their houses tottering with age, or constructed upon infirm base-ments, threaten ruin. So too, I believe it is not consentaneous to reason that some private person excogitating reforms in public affairs should desire that existing things should be fundamentally abolished that he may introduce a better order in their place. Thus I do not desire that the commonly known sciences, or the mode of teaching them in use in the academies should be altered. But as regards those opinions which I myself had held until then, I decided that I could do nothing better than to blot them all out at the same time and once for all, that I might afterwards adopt better ones, or certainly the same if they stood the test of mature reason ; and I believed that by this means I should be better informed for the conduct of life than if I retained the foundations of the old building, and still adhered to the principles which, formerly, during my youth had gained my credence without being subjected to any test as to whether or not they were conformable to truth. Although in this I encountered many difficulties, yet they had their own remedies, and were not to be compared with those that occur in the reformation of a republic. If great bodies once fall, they are scarcely raised again with adequate effort ; when shaken they are scarcely held fast, and likewise all their fall is heavy. Then if there be imperfections in public affairs as the variety itself which is found in them among the different nations plainly shews that all are not perfect ; such imperfections are rendered tolerable by long usage, and many are either amended, or avoided when human wisdom can conceive no other relief ; and lastly, they are always more easily born by the people accustomed to them than their change. In like manner we see royal roads constructed in the windings of mountains, crooked and whirling, made even and suitable by constant use, so that we rather choose to follow them than to force a more direct passage by ascending to the tops of the mountains and rushing

down the precipices. I therefore especially hate those light-minded and unquiet individuals whom neither birth nor fortune calls to the administration of public affairs, always busying themselves with meditations of reforming them. And so, if even the least part of this treatise were capable of being held that I labour under the same delusion, I should withhold it altogether from public view. My excogitations are intended to correct my own opinions and to enable me to build on soil which is entirely my own. And although, because my work pleases myself well, I propose its model to the public, I do not wish that I should be counsel to anybody in order to induce him to attempt something similar. Others perhaps whom God has endowed with pre-eminent intellects will be able to perfect greater things, but I fear that the work which I have undertaken is so hard and difficult that very few will be induced to imitate it. For even this, that we lay down the opinions with which we once became imbued, will not be attempted by every one. The greatest part of mankind is divided into two kinds; neither will agree with the other. There are evidently many who, with too much confidence in their own abilities, are apt to jump to conclusions without allowing themselves time enough for the purpose of examining all the arguments; and therefore if they once begin to doubt the popular beliefs and leave the beaten tract, they do not easily keep always to that foot-path which is more direct; but unsteady and uncertain, wander about during the remainder of their lives. All others, on the other hand, having enough of discretion and moderation to see that there are in the world some who surpass them in wisdom, seek rather to be guided by the latter than to attempt to evolve rules of conduct for themselves from their own brains.

As for myself, I might, without doubt have been in the latter class if I had only one preceptor, and had not known those diverse doctrines which clashed with those of the most learned. But I had already learnt in the academies that there was nothing so absurd as might not be attributed to one of the philosophers; I had also observed, in my travels, that all whose doctrines were entirely different from ours were not to be regarded as bar-

barous and therefore dull-headed ; and that many of them had intellects either equal or superior to ours. I had also considered how different the same man with the same intellectual faculty would have turned out if from early youth he had lived in France, or Germany, instead of being brought up either among the Chinese or the Americans ; and how much also in many things not in themselves of great moment, such, for instance, as the form of the clothes which we wear which has highly pleased us for the last ten years, and which will perhaps please us again ten years hence, appears to us now as silly and unsuitable,—we are guided rather by example and custom than by true knowledge. Lastly I perceived that in respect of things the truth of which cannot easily be investigated, there is nothing to which we ought to give less credit than to the number of suffrages ; for it is more likely that the invention of suffrages is due to one than to many individuals. And because I was not able to select any from among many whose opinions appearing worthy of adoption, I might adopt and prefer to others, I was in a certain way forced to use my own counsel for regulating my life.

But according to the example of those who journey at night and in darkness, I have resolved to step forward slowly and with suspended pace and to survey everything so diligently as not to make much progress, but at least to guard myself against a fall. Nor did I wish to attempt at once to abandon those opinions which I had formerly adopted without any reason persuading me to adopt them, but as people dwelling in an old house do not pull it down before they have designed a plan of constructing a new one in its place, so I previously thought by what means I might devise something certain, and spent much time in seeking out a certain method which might direct me to the knowledge of all those things which my intellect was capable of comprehending.

I had previously studied in the academies logic as a part of philosophy, and analytic geometry and algebra as parts of mathematical discipline ; the three arts or sciences which appeared to render me some help to my institute. But by more diligently examining them, I have, as to what appertains to logic, ascer-

tained that the forms of syllogisms and almost all its other rules are not so useful for investigating things which we do not know, as to expound to others those which we know ; or, as the Lullian Method, to teach us to gabble diffusely and indiscreetly of things which we know not. And although it contains many rules at once the most certain and the best, yet they are so mixed with many others which are either superfluous or noxious that it is not a less difficult task to distinguish or separate them, than to raise either Diana or Minerva from unwrought marble. As to what appertains to the analytic geometry of the ancients, and the algebra of moderns, both seem to refer only to certain speculations which are of no practical value : analytic geometry concerning itself so entirely with the consideration of figures that, while it sharpens and exercises the intellectual faculty, it tires and afflicts the faculty of imagination or reflection ; algebra as it is taught, is so concerned with certain rules and formulas of calculation as to be rather a confused art by the use of which the intellectual faculty is more disconcerted and obscured than improved by any knowledge or rendered more perspicuous. I have therefore resolved to seek out some other method in which whatever is of use in the said three branches of knowledge may be found while avoiding their evils. And as a multitude of laws always tends more to excuse crime than to suppress it, and such states are best constituted as have only a few laws which are rigidly enforced, so in the place of that immense multitude of precepts with which logic is full, I consider the following four rules to be sufficient for me, provided I firmly and deliberately resolve not even once to deviate from them during my life.

The first rule is not to admit as true any thing unless I can ascertain it as certainly and evidently true ; that is to say, that I should diligently avoid all precipitation and anticipation in forming a judgment ; adopt nothing more in conclusion than that which is so clear and distinct to my understanding as is nowise possible to be again doubted.

The second is, to divide the difficult questions to be examined into as many parts as is expedient for their convenient solution.

The third rule is, always to arrange in a certain order all thoughts which I may employ in the investigation of truth; beginning from things which are the most simple and the most easy to be ascertained, so that little by little and step by step, as it were, I may ascend to the knowledge of things most difficult and most composite; also arranging in my mind in the same order those thoughts which from their nature do not mutually precede them.

And lastly, both in searching for common things and in traversing parts of difficult questions, to consider every single thing thoroughly, and to survey all in order to be certain that I omit nothing.

Those long chains of the very simple and easy reasonings by the help of which geometricians are led to the solutions of the most difficult problems, have furnished me with the means of coming to the knowledge that everything which comes to our knowledge follows mutually from each other in the same order; and that so long as we do not admit anything false as true, and always observe the order in which one thing is deduced from another, there will be nothing so remote at which we shall not at length arrive, nor so obstruse which we shall not unravel. Nor was it difficult for me to see from what things I should begin my investigation. For I had already determined that I should first of all examine things which are of the simplest nature, and which are the most easy to be known; and as I know that of all who have hitherto engaged themselves in the investigation of truth in sciences, the mathematicians alone have been able to devise certain demonstrations, that is, to invent certain evident reasonings; I know equally well that they have done this in respect to that which is the easiest of all, and that I should therefore first examine it although I could expect no other advantage from such examination than to inure my mind gradually to comprehend truth, and not to assent to false reasonings; nor was I therefore to attempt to learn immediately all those particular sciences which are commonly called the mathematical; but as I had already observed that although they concern different objects, yet because

all agree in this, that they do nothing more than examine certain relations or proportions which are seen in those objects, I have resolved to consider only those proportions as are most generally observed, and also only in reference to those objects by means of which the knowledge of those sciences is made easier ; and not to bind those sciences to those objects only, but to transfer them to all other things to which they may be applied. And then, because I had observed that sometimes in order to comprehend such things as are concerned about the said proportions, single proportions are to be separately considered, and that sometimes many are to be viewed together and retained in memory, I thought that it would be the most preferable course to substitute only right lines for them, as often as they were to be separately considered, because there can be nothing more simple or more distinct to be exhibited both to the imagination and to the senses themselves than to designate them by the briefest possible characters or notes as often as they are to be retained in memory, or more than once to be simultaneously comprehended. In this manner whatever is useful in analytic geometry and algebra I have adopted, and avoided every fault, supplying the defects of the one by the help of the other.

I am bold to assert that by accurately observing those rules which I had framed, I have acquired such facility for surmounting all the difficulties about which the said two sciences are concerned, as within two or three months which I spent in that study, to be able not only to solve many problems which had previously appeared to me to be the most difficult, but also at last to progress so far as to be able to determine by what ways and how far such problems as I had previously not known, could be solved by human intellect. As I began from the most simple and the most general, and then observed the order of sequence, every truth at which I arrived furnished me a rule which I afterwards applied to the solution of more difficult questions. And lest anybody may perhaps think that I am here making mere boastful assertions, it must be noted that of every thing there is only one truth, and that if anybody clearly perceives it, he knows as much about it as anybody else can know. Thus

a boy who has learned only the first rules of arithmetic in school and rightly observed them in adding up several numbers, can without rashness affirm that he has, so far as addition is concerned, ascertained all that which is possible to be ascertained by human ingenuity. And the method which teaches us to follow the true order and to make accurate calculations does not yield to arithmetical certainty. This method has especially pleased me in this, that by its means I am certain to use reasoning in every thing, if not perfectly, yet at least in the best way I am able; and know by its use to gradually dissipate the darkness of my mind and to accustom it to perceive truth more distinctly and more clearly. As I do not restrict this method to any particular subject, I hope to use it freely in the solution of the difficulties of the other sciences than geometry and algebra. Although I do not therefore immediately undertake the solution of all the difficulties which occur,—as it would be deviating from the order which the method prescribes,—yet as I see that their knowledge depends on certain principles which ought to be sought from philosophy, in which however no principles sufficiently certain are as yet established; I doubt not that before everything else, I must apply myself to their investigation. And as I see that their disquisition is of the highest moment and that there is no other subject in which precipitation and anticipation of opinions are to be more diligently guarded against, I thought that I ought not to approach it before attaining mature age; because I was at that time only twenty-two years old; nor had I previously spent much time in preparing my mind for it, either by effacing the erroneous opinions which it had before admitted, or by gathering varied experience capable of furnishing me with matter for my ratiocinations, and also by improving more and more the method which I had prescribed to myself, in order that I might come out more confirmed in it.

III. As those who want to build a new house in the place of

Certain rules of the
moral science drawn
from this method.

that which they inhabit, not only pull down
beforehand the old one, and prepare stone,
wood, cement and other building materials,

consult an architect, or exercise themselves in architecture, and accurately design the plan of the new house; but also prepare another house which they may dwell in comfortably, meanwhile, during the time the new house is being built; so instead of dubiously and anxiously wavering as to what I have to do,—reason persuading me to be in doubt about the things I have to form a judgment of,—and in order to begin to live a happy life thenceforward, I have formed for myself for the time being a certain moral code, consisting only of three or four rules which it will not be amiss to describe below.

The first rule is to conform to the laws and institutions of my native country, and to retain that religion which I deem the best, and in which I have been brought up by God's grace, and to govern myself in everything else according to the most moderate opinions which are remote from every extreme, and are commonly adopted by the wisest of those among whom I am to live. As I am to begin from doubting everything in which I have hitherto had confidence, seeing that I have resolved to examine everything afresh, I am certain that I can do nothing better than, meanwhile, to imitate the example of wise men. And although there are perhaps among the Persians, or the Chinese wiser men than among us, I think it is more convenient to follow those among whom I am to live; and in order to comprehend what is really held by them to be the most preferable course, I attend rather to what they do than to what they say, not only because men's morals have been so far corrupted that there are very few who like to manifest what they think, but also because many are often ignorant; for the action of the mind by which we judge anything to be good or bad is different from that by which we understand that we so judge; and most frequently the one is known from the other. Out of a number of opinions equally held I always choose the most moderate, both because they are the most easy of execution, and the best,—seeing that every thing is wont to be exceedingly vicious,—and because if by any chance I err, I may by holding a middle course at least deviate less from the right path than if I follow one of the extremes, while the other is that which ought to be followed. And bet-

ween the two extremes I lay down all the promises by which we deprive ourselves of the liberty of afterwards changing our minds. Not that I do not approve of the laws which, having regard to human frailty and inconsistency, permit us as long as our course is good to bind ourselves to persevere in the same course; or which, even according to commercial faith, whatever we promise to others, provided it is not against good morals, compel us to fulfil; but because I see that there is nothing in the world which always remains in the same state, and because, as regards myself, I have so ordered my life as to hope that my judging faculty should daily become better, never worse, I thought I should commit a grave error against good conscience if I still adhered to those opinions which I once held as good, even after they had ceased to be good, or I myself had ceased to think that they were any longer good.

The second rule is to hold to my resolution as steadily and as firmly as possible, nor to prosecute less indubitably and less unhesitatingly those things which I undertake to do with very dubious reasons, or, possibly, without any reason at all, than those of which I am plainly certain. In this I imitate the example of the travellers who, if by chance they lose their way in the midst of some forest, and neither find any that is trodden by others, nor know the direction in which they are to proceed, do not wander in uncertainty now in this direction, now in that, much less stand in one place, but proceed steadily in one direction, without afterwards turning aside from it for light reasons, although at first they had no reason whatever why they should proceed in that direction instead of another; for in this manner if they do not reach their destination, they yet arrive at some place where they may put up more comfortably than in the midst of a forest. Thus as there are many things in life which cannot be deferred, it is most preferable, as often as we do not know the best course to be adopted, to follow that which appears to be the best; or certainly, if there are more courses than one, all equal in themselves from which we cannot choose one preferentially to another, we must choose some one; and after we have chosen to adopt a certain course, we should no more look upon it as doubtful with

reference to execution, but plainly as true and certain; because the reason which led us to choose it was true and certain. And this is sufficient to free us from all such anxieties and bitings of conscience as torment unsteady persons; because they chose many things as good at the same time, which with wavering judgment they afterwards persuade themselves to be bad.

The third rule is to attempt rather to subdue myself than to try to subdue Providence, and to alter my own desires than to alter the course of nature; in general to persuade myself firmly that beyond our thoughts there is absolutely nothing which is our own; so that whatever does not happen after we have exerted ourselves to our utmost that it should happen, we ought to class among things which are impossible, or in the language of philosophy, to regard as one of the impossibles. This alone appears to me to be sufficient to guard me against hoping that which I do not obtain now, will be obtained at some future time; and thus to make myself happy. For, seeing that it is the nature of our will to desire nothing except what our intellect represents to it as possible in some way, if we consider that all the good things which are outside of ourselves are equally impossible to us, we shall not be sorry that we want those things which appear to be our dues at our birth, any more than if we are not the kings of China or Mexico. We must adapt our minds strictly to the necessity of the things that we may not now bewail over the fact that our bodies are not as little subject to corruption as steel, or that we are not furnished with wings to fly as birds; nor to be racked because the soundness of our minds fails when we are ailing, or because our liberty is taken away from us when we are in prison. But I must admit that the longest exercise and the most repeated meditation are necessary to accustom our minds to look at things in this light. And in this alone, I am convinced, is contained the whole secret of those philosophers who formerly renounced imperial fortunes, and amid the torments and discomforts of want vied with their gods in respect of happiness. Because, when they carefully considered the bounds to their power prescribed by nature, they were fully convinced that there was nothing outside of them-

selves, or that nothing beyond their own thoughts belonged to themselves ; so that they not only desired nothing more, but also acquired by such exercise and meditation such a complete control over themselves, that is, they so habituated themselves as to subdue their desires and emotions, that without any further reason they thought themselves alone to be rich, themselves alone to be powerful, themselves alone to be free, and themselves alone to be happy ; as nobody else indeed uninstructed in such philosophy can ever hold nature and fortune so favouring him always as to make him believe that he has in himself every thing that he can desire.

To conclude my moral code or science of duty ; having for some time considered the diverse pursuits in life of men, and endeavoured to select the best ; it is not necessary that I should here relate anything as to what appears to me respecting others ; I may only say that I have found nothing to be as good as to persevere in the task in which I am engaged, that is, to spend the whole of my life in investigating truth according to the method which I have prescribed to myself. I have tasted such fruits of this method, as make me sure that I shall not find sweeter or more innocuous ones in this life ; seeing that by means of the same method I make every day some previously to the public unknown discovery of some importance which fills my mind with so much delectation as to keep it unaffected by other matters. Besides this, the three rules which I have now expounded would not be sufficiently positive unless in the investigation of truth I resolved to follow this method. For as God has given every one of us some light of reason for distinguishing truth from falsehood, I do not think that even for a single day I can be governed entirely by the opinions of others, unless as soon as I determine to act rightly in this respect, I subject them to the examination of my own intellect. Nor can I so long as I follow the said rules be without fear of erring, unless at the same time I hope never to pretermitt any occasion of finding better ones ; nor, lastly, can I subdue my passions and be content with what I have in my power, unless I follow that way by which I trust to arrive at the knowledge of every thing of which I am capa-

ble, and, at the same time, to be possessed of all good things to which I may aspire. Since our minds do not determine to adopt or avoid anything unless it is shewn by the intellect as good or bad, it will be sufficient, if we always judge rightly that we may act rightly; and, if we are able to judge in the best possible manner, that we may be able to act in the best possible manner; that is, that we acquire all virtues, and every other good which can come to us; indeed whoever believes to have thus acquired them, cannot but be content and happy with them. ✕

After instructing myself with these rules, and reserving those things which are for me of the highest importance, together with matters of faith; I have not hesitated to blot out from my mind everything else with which I ever became imbued. As this appeared to me more easy to be done by mixing myself with people than by staying longer in that solitude in which I then was; the winter scarcely ended when I again prepared myself for travel; nor during the following nine years did I do anything else than by visiting every place, to exhibit myself rather as a spectator than as an actor in the comedies which are being every day acted in the world. When in respect to each thing I chiefly attended to that which was to be doubted, and what was the cause of our forming incorrect judgments, I gradually erased from my mind the erroneous opinions with which it was beset. I did not in this follow the sceptics who doubt only that they may doubt, and seek for nothing else than uncertainty. For, on the contrary, my object was to see if I could discover in each single thing any thing of certainty; and, as is usual when a building is to be constructed on a sandy soil, I wished to dig so deeply as to reach at length either stone or clay; this indeed appeared to turn out sufficiently auspicious to me. Because, when, for the purpose of discovering the falsity or uncertainty of propositions which I examined, I attempted to use not vague and weak conjectures, but firm and evident arguments, there never occurred anything so doubtful but I saw always some certainty in it; this at least, that there was not the least certainty in it. And, as those

who pull down the old house find in it much material fit to be used in the new building; so in rejecting my ill-founded opinions, I observed many things and gathered much experience which were afterwards of use to me for confirming the more certain ones. And, moreover, I always continued to test the method which I had prescribed to myself; nor did I only study to govern all my thoughts generally according to its rules, but sometimes I used to spend some hours in applying it more expressly to the solution of mathematical problems; even of questions appertaining to the other sciences, which from the fact of their not resting on sufficiently firm foundations may still be called the mathematical. That I have done this will sufficiently appear from many things which are contained in this pamphlet. Thus by acting not specifically otherwise than those who studying to lead their lives quietly and innocently, free from every other employment, separate pleasures from vices, and deny themselves no honest delectation, so as to be able to bear their leisure without disgust; I meanwhile enforced my own determination, and promoted more, as I believe, the knowledge of truth than if I had chosen to spend all my time in turning over books, and in listening to the discourses of the learned.

But the said nine years passed away before I was able to come to a determinate conclusion in any of those questions which are discussed among the learned, or to arrive at any principles more certain than those commonly held in philosophy. For, the examples of many distinguished intellects which appeared to have hitherto undertaken the same task without success, taught me that there was such a difficulty in this, that I should have delayed still longer, if I had not heard it generally believed by certain people that I had perfected the work which I had not as yet approached. I do not know what has given them the occasion for believing so; because my own utterances could not have furnished them any, unless perchance they had seen me admitting my own ignorance more freely than some of those who wish themselves to be esteemed as learned; or because I sometimes explained my reasons why I doubted many things

which were held by others as certain; though certainly not because they had ever heard me glorying myself in my knowledge of things philosophical; but, as I did not wish to be held otherwise than I really was, I thought I should exert with all my might to be really worthy of the praise which was bestowed on me. Thus urged eight years ago, in order to disengage myself from such avocations as occur to those who live among acquaintances and friends, I withdrew myself to these regions into which the necessity of a long war has introduced so good a military discipline, that great armies appear to be trained in it for no other purpose than that the inhabitants may securely enjoy all the comforts of peace; and in a great multitude of busy people more attentive to their own affairs than prying into those of others, I neither wanted the use of those things which are to be had only in the most flourishing and most populous cities, nor did I meanwhile live less solitarily and less quietly than if I had been living at places mostly deserted and uncultivated.

IV. I do not willingly refer here to the first reflections to which I applied my mind after coming here.

Reasons by which are proved the existence of God and human life, which are the foundations of metaphysics.

The science of mind or metaphysics is so far removed from common apprehension, that I fear it is not likely to please many; but in order to test whether the foundations of my philosophy are sufficiently firm, I am somewhat forced to speak about that science. I have already observed that there are many opinions which, although dubious and uncertain, we are, as has been said before, bound to follow not less steadily and fearlessly in so far as they refer to the use of life than if they had been tested and confirmed. But, seeing that I then wished to devote myself entirely to the investigation of truth, not to the execution of things, I thought that I was to follow the directly opposite course and to reject as plainly false everything in which I found the least room for doubt, in order to see, after their rejection, if there was nothing left about which I could possibly have no doubt whatever. Thus because our senses sometime deceive us, whatever I have drawn from them, I reckoned as false; and because I had sometimes observed some

people erring about the easiest things in geometry and admitting false arguments, and knew that the same might happen to me as to anybody else; I also rejected as false all those things which I had previously held as demonstrated truths; lastly because nothing appears to us as true while we are awake which does not appear equally so during our sleep, when then always or almost always it must be false, I suppose that none of those things of which I think while awake can be truer than the sports of dreams. But immediately afterwards, I observed that although I had thus rejected every thing else as false, I could not possibly doubt that I myself existed meanwhile; and because I saw the truth of these articulations: *I think*, therefore *I am* or *exist*, so certain and evident that no cogent reason could be conceived by the sceptics for doubting, which could remove that certainty, I believed that I could safely admit that as the first foundation of that philosophy which I was then endeavouring to construct.

Then carefully examining who I am and seeing that I can conceive that my body is nothing, likewise that the world does not exist, or the place where I am; but by no means to be able to conceive that I do not exist, nay, from this itself that I can conceive everything else to be false, or whatever else I can think of will manifestly follow me: and on the contrary, if I cease to think even for a moment, although in the meantime my body, the world, and everything else which I have ever imagined exist in reality as they are, there is no reason why I should on that account believe that I exist during that time; hence I perceive that I am a certain thing or substance of which the whole nature or essence consists only in this that I think, and which that it may exist neither desiderates space, nor depends on anything either material or coporeal. So that *I*, that is, the mind by which I am such as I am, is a thing distinct from the body, and also easier to be perceived than the body, and which may plainly be the same in the future as that which is now, although the body itself may not exist.

After this I applied myself to ascertain what was in general required for an enunciation to be regarded as true and certain;

and when I discovered one which could be regarded as such, I thought I could see from it what its certainty consisted in. And because I saw nothing in the words *I think, therefore I am or exist* which might make me certain of their truth, except the most plain fact that it is impossible for anybody to think unless he is or exists, I believed that I might assume it as a general rule that every thing of which I have a perfectly clear and distinct notion is true; and that the only difficulty is to observe rightly what it is that we distinctly perceive.

Next, I saw that I doubted about many things in the same way as if my nature itself was not wholly perfect, because it is most certain that doubt is not the proof of perfection as knowledge is. And, when I inquired further from whom I could have the faculty of thinking of a nature more perfect than mine, I clearly saw that I could not get this except from a nature in reality more perfect. So far as thoughts are concerned which occur regarding various other objects outside of myself, such as the heavens, the earth, light, heat, and other innumerable objects, I thought I could not inquire of them in the same manner as to their source, for when I found nothing in them which appeared to be above myself, I could easily believe, that if true, they depended on my own nature itself so far as it has anything of perfection in itself; but, if false, they were produced from nothing, that is, they were within myself from no other cause than because there is some defect in my nature which is therefore not perfect. But I could not judge the same

Note that, here as in the sequel, the word *idea* is taken generally as referring to every thing cogitated so far as it is an object of intellect.

of thought or idea of a nature which is more perfect than myself. Because it was plainly impossible that I could draw my ideas from nothing. And because what is more perfect cannot emanate from what is less so, in the same manner as nothing can be done out of nothing, it is impossible that I can have my ideas even from myself; and hence it follows that the idea must be placed in me by a thing whose nature is more perfect; even that which contains in itself all perfections of which I have some idea in me, that is, to express it in a word, which is God. I have also added that since there

are some perfections of which I am unaware, it is necessary that there must exist beyond me some other *ens*, (to use here such a term as is common among schoolmen), *ens* I say more perfect than myself, on which I depend and from which I derive all that is in me. For, if I am sole and independent of another, in so much that all that, how little soever it may be, of the perfection of which I am a partaker, I have from myself, I can also acquire through me everything else in which I know I am deficient, and thus I myself can be infinite, eternal, immutable, omniscient, omnipotent, and, in fine, can possess all perfections which I know are in God.

But that I may know the nature of God, (his surely whose existence the now adduced reasons prove), so far as it may be naturally known to me, I have to do nothing else than consider with regard to all things of which I find ideas in me, whether it is perfection to have them; and I am certain that none of those which denote any imperfection can be in God as none of the remaining can be wanting in him. So I see that doubt, changeableness, sadness and the like cannot happen to God, because I myself would gladly be without them. Besides, my ideas of many sensible and corporeal things I might feign to be dreams, and hold as false whatever I might see and imagine; but I cannot deny that I have such ideas in my mind. But because I plainly perceive in myself an intelligent nature distinct from the corporeal nature, I see that in every composition one part depends upon another, and that the whole world depends on its parts, and also that that cannot be perfect which depends on another. As therefore it is to be held that there can be no perfection in God, if he consists of these two natures, it follows that he does not consist of them. But if there are in the world anything corporeal, or any intelligent beings, or any other nature which is not altogether perfect, their existence so necessarily depends on the power of God, that they cannot exist without him even for a moment.

Thence preparing myself for the investigation of other truths, and first directing my attention to what geometry is concerned about, seeing that I conceive it to be a continuous body, or a

space indefinitely long, broad, and deep, devisable into diverse parts by all means as to magnitude and figure,—parts which can be transferred and moved in every way, (these the geometricians suppose to be present in that which they examine), some I recall to my memory on account of their most simple demonstrations. And first I note that that great certainty which is derived from the consensus of them all proceeds only from the fact that it is very clearly and distinctly perceived, according to the rule which has been given a little before; then I also note that there is plainly nothing in those demonstrations which makes us certain of the existence of that about which they are concerned; for although I see plain enough, when, for example, a triangle is given that its three angles are necessarily equal to two right angles; I see nothing which makes me certain that there is a triangle in nature. But, on the other hand, when I return to the idea of that perfect entity which I have in me, I at once perceive that existence is contained in it by the same reasoning according to which the equality of the three angles of a triangle is contained in idea in two right angles; or as, in the idea of a circle, yet more evidently, the equal distance from the centre of all its parts to the circumference; and therefore that there is God who is that perfect entity, is equally as certain as any geometrical demonstration can be.

But the whole reasoning by means of which many are convinced that the existence of God, and the nature of human life are matters very difficult to be understood, proceeds from this that they do not separate the mind from the senses, and raise it above things corporeal; they are not accustomed to consider anything which cannot be imagined, that is, nothing whose image cannot be pictured in their mind as of something corporeal, as nothing of which they can conceive no such image can even be comprehended by them. And this is sufficiently plain from the fact that philosophers commonly lay down as an axiom in the academies that, there can be nothing in the intellect which has not a previous existence in the sense in which, it is indeed most certain, that the ideas of God and rational life can never be: and they who wish to use their imagining faculty for these

ideas seem to me to do the same thing as those who for hearing sounds and perceiving odours attempt to use their eyes; although there is in this also the difference that the sense of the eyes is not less certain in us than that of either scent or sound; when, on the contrary neither the faculty of imagining, nor that of sense can make us certain of any thing except with the co-operation of the intellect or reason.

If, lastly, there be yet some whom the reasons already adduced do not convince that there is God, and that life is different from body, I desire them to direct their attention to the fact that all other things of which they are never wont to doubt, such as they themselves have bodies, that there are in the universe stars, earth, and the like are much less certain. For although there is of all these things a certainty only moral, as philosophers say, yet it is such as no sane man can possibly doubt; no man indeed unless destitute of reason can deny so long as the question is of metaphysical certainty; but there is sufficient reason for doubting those things which we see done during our sleep; we plainly believe ourselves to have other bodies, and to see other stars, other earth, and so forth, which are indeed false: from whence does the knowledge come that the thoughts which occur during our sleep are rather false than those which come when we are awake, although the former are often not less vivid and less exact than the latter? Let the keenest intellects set themselves to work as they like about this; I think no reason whatever can be found which will be able to remove the cause of doubt except the existence of God. For, that which I have already adopted as a rule, that everything of which we have a clear and distinct conception is true, derives its certainty from no other cause than that there is God, and that God is the supreme and perfect entity, so that whatever of entity is in us, proceeds from that entity. It therefore follows that our ideas or notions when clear and distinct are certain entities, and proceeding from God cannot but be true. But, although we have many ideas or notions in which a certain amount of falsity is involved, this does not happen from any other cause than that there is in them some obscurity or confusion; and in this they owe their rise

not to the supreme entity but to nothing, that is, they are obscure and confused because something is wanting in us, or because we are not altogether perfect. It is indeed manifest that it is impossible for any thing false and imperfect to be in God any more than truth or perfection can emanate from nothing. But if we do not see that whatever of entity or of truth is in us, proceeds from supreme and infinite entity, although our ideas are clear and distinct, no reason will make us certain that they are therefore true.

But after the knowledge of God and of our mind has proved the truth of the before adverted rule, it is easy for us to understand, that on account of the errors of dreams, we ought not to doubt the thoughts which we have when we are awake; for if even during sleep, anybody should have a very distinct idea of any thing, as for example, if a geometrician should find a new demonstration, his sleep indeed does not make it less true. The error which is most familiar to our dreams, that indeed which consists in its representing various objects to us plainly in the same manner as they are exhibited to us while we are awake by our external senses, does not hurt us in this that it gives us occasion to give less credit to such ideas as we either accept or think to accept from the senses; because the latter deceive us not rarely even when we are awake, as those who are affected with jaundice see every object in a yellow colour, or as the stars or other very remote objects appear to us much smaller than they really are. Whether we are awake or asleep our judgments ought in all to follow the evidence of reason. It must be here noted that I speak of the evidence of reason, not indeed of the imagination, nor of the senses. For example, although we see the sun clearly, we ought not to judge that he is only of the same magnitude as our eyes exhibit him to us; and although we distinctly imagine the head of a lion fixed to the body of a goat, yet we ought not thence to conclude that there is a chimera in nature. Reason does not dictate to us that the objects which we thus see or imagine really exist in nature. What reason plainly dictates to us is that all our ideas or notions have something of truth in them; otherwise it cannot be that God who is supremely

perfect and true would have planted them in us. And because our reasonings or judgments are never so clear and distinct during our sleep as when we are awake, though sometimes our imaginations are more vivid and exact, reason also dictates to us,—seeing that all our thoughts cannot be true because we are not altogether perfect,—that they (our thoughts) are more true which we have when we are awake than those which occur to us when we are asleep.

V. I would now most gladly proceed and exhibit the whole chain of truths which I have deduced from

The order of the physical questions investigated by the author; and the explanation particularly of the motion of the heart and of certain other vexed questions affecting the science of medicine; and the difference between our life and that of the brute animals.

the above principles; but because it would then be necessary for this purpose that I should treat of the various questions discussed among the learned with whom I do not wish to drag the cord of contention, I believe it would be more satisfactory if I were to abstain from them and only indicate of what kind they are, from which the wise

may be able to decide whether it will be of use to the republic of letters to be more particularly informed of them. I have always adhered to the resolution of applying no other principle than that which I have used for the purpose of demonstrating the existence of God and life, of accepting nothing as true unless it appeared clearer and more certain to me than the demonstrations of the geometricians had appeared before. And I venture to assert that I have not only found the way by which I have in a short time satisfied myself in all the principal questions which are wont to be treated in philosophy, but to have also observed certain laws to be so constituted by God in nature and their notions so impressed on our minds, that after attending to them we can never fail to observe them accurately in every thing that is or being done in nature. Lastly, depending upon the series of these laws, I have perceived many truths which are of greater moment than those which I had learnt before, or hoped to learn.

But because I have endeavoured to explain the principal of them in a particular tractate which certain reasons prohibit

my publishing, I cannot do better to signify what those truths are than to indicate here the sum and substance of the said tractate. It was my resolution that this tractate should embrace everything which I thought I knew regarding the nature of material objects before I undertook to write it. But as painters, seeing that every part of a solid body cannot be so painted as to be seen in a plain picture, choose one of the principal parts which alone they turn to light, and, dimming the other parts, desire only so much to be seen as can be seen by seeing the so chosen principal part; so fearing that I should not be able to compass every thing in the said tractate, which I revolved in my mind, I resolved to expatiate upon those things which I conceived regarding the nature of light; then to add something regarding the sun and fixed stars, seeing that almost all light emanates from them; regarding the heavens which transmit it, and the planets, and the comets, and the earth which reflects it; and particularly regarding all bodies which occur on the earth, coloured, transparent or luminous; and lastly, regarding man because he is the spectator of all. Moreover, that I might throw some shadows about all these, and express more fully my sentiments about them, nor indeed, hold myself liable either to follow or refute the opinions accepted by the learned; I determined to leave this world entirely to their disputations, and to treat only about those things which might occur in a new one; if God created anywhere in imaginary spaces sufficient matter for composing it, and agitated the parts of this matter variously and without order, so that from it he might raise an equally confused chaos as poets are able to feign; then to do nothing else than to adapt his own ordinary course to the so created nature; and allow it to proceed according to the laws constituted by himself. Thus I first described this matter, and endeavoured to depict the same that nothing according to my opinion could be clearer or more intelligible in the world, those things only accepted which have already been said regarding God and life. For I expressly resolved that in this matter there should not be such forms, or such qualities, as those about which disputations are carried on in the academies, nothing in kind whose

knowledge is not so natural to our minds that nobody can feign that he is ignorant of it. I have also shewn what the laws of nature are, assuming no other principle for basing my reasonings upon than the infinite perfection of God; I have studied to demonstrate all those laws about which any doubt may arise, and to prove them to be such that even if God create more worlds, there can be none in which they may not be accurately observed. Afterwards I have shewn how the greatest part of this matter, chaos, disposes and collocates itself so as to be similar to our heavens; how meantime some of its parts compose the earth, what parts compose the planets and the comets, and what the sun and the fixed stars. And here having entered upon a dissertation of light, I have fully explained what it must be that could compose the sun and the stars, how in a moment of time it traverses the immense space of the heavens, and from the planets and the comets it reflects on the earth. I have also expatiated upon the substance, site and motions, and upon all the diverse qualities of the sky and stars; so that I might satisfy myself to have said enough to shew that I had observed nothing in the heavens of this universe which does not or cannot similarly appear in that which I have described. Then proceeding to treat of the earth, I have shown why, although, as I have expressly stated, God has not endowed the matter with which the earth is composed with gravity, all its parts accurately tend to the centre. Again how when the surface of the earth is covered with air and water, the disposition of the sky, of the stars, and chiefly of the moon, ought to effect in it the flux and reflux, similar in all their circumstances to those which are observed in our seas; also the particular motion of water and air from east to west, such as is observed between the tropics. How the mountains, the seas, the fountains and the rivers are naturally produced on the earth, metals are engendered in mines, plants grow in the fields, and generally all bodies which are commonly called mixed or composite are generated. And among the rest, because I know of nothing which, barring the stars, produces light in the world except the fire, I have endeavoured to explain perspicuously every thing which appertains to the nature

of that element; how it is made, how it is kept up, why sometimes heat alone without light, and at others light alone without heat is found in it; how the various colours are capable of being produced in different bodies, and diverse other qualities; how the same earth liquifies certain things, while it hardens others; how it nearly consumes every thing or is able to convert it into ashes or smoke; and lastly, how from the ashes glass is produced by the force of their action alone. Seeing that the conversion of the ashes to glass is not less admirable than anything else which occurs in nature, I have indulged myself somewhat in expatiating on this particular subject.

I did not wish to infer from all these that this world was created in the manner I have stated. It is much more probable that God created it in the beginning such as it was intended to be. But it is certain and commonly accepted by the theologians that God preserves it by the same action now by which he formerly created it; so that, although he gave it from the beginning no other form than chaos, while after the constitution of the laws of nature, its own course of action, as usual, accommodates itself to it, the belief that all the material objects were made with it to be such in time as we now see them, can remain unaffected without any injury to the miracle of creation. The nature of material objects can be more easily comprehended when they are rising up little by little than if they are considered when finished and perfect.

From the description of inanimate bodies and plants I passed to animals, and especially to man. But because I had not as yet obtained sufficient knowledge of these to enable me to treat of them in the same manner as of the other matters, that is, by demonstrating effects from causes, and showing from what seeds, or by what mode nature must produce them, I contented myself to assume that God forms man's body in every respect similar to that which we have, both in the external shape of the members, and in the internal configuration of the organs from the same matter which I had described, but does not endow it with rational life from the beginning, or with anything else which might be in the place of vegetable or sentient life; but

excites in its heart only some fire without light which I had already described ; which does not appear to be different from that which makes heaped hay heated before it becomes dry, or which makes new wine not yet separated from grapestone ferment. For, reflecting upon the functions which as consequences are in the human body, I find all of them to exist there which are in us when we are not thinking, as it were without the co-operation of life, that is of that part of us which is distinct from the body, whose nature as already explained consists only in thinking, the same in which, it may be said, animals destitute of reason resemble us ; so that none of them depend on the mind, seeing that all those functions which depend on the mind being ours alone distinguish us as men ; which nevertheless I afterwards find there, when I supposed God had created rational life and joined it, in a certain manner, which I described, to the body.

But in order to shew how I treated of this matter in the aforementioned tractate, I wish to give here an account of the motion of the heart and of the arteries, from which, as they are the first and most generally observed in the animals, it may be easily inferred what is to be understood regarding the rest. And that there may be less difficulty in comprehending the matters of which I am about to write, I advise those who are not versed in anatomy that before they prepare themselves to read these observations, they get some large animal having lungs dissected before themselves because it is in every respect sufficiently similar to a human being, and to inspect the two ventricles or cavities which are there ; first, that which is in the right side, to which two very large canals correspond ; namely, the hollow vein which is the main receptacle of blood, like the trunk of a tree, of which all other veins of the body are the branches ; and the arterial vein,—an ill-adapted name,—seeing that it is in truth an artery, which having its origin in the heart, after it leaves it, is divided into many branches which are then dispersed through the lungs ; secondly, that which is in the left side to which in the same manner correspond two canals, equally large as the preceding if not larger ; namely, a veined artery,—badly so named

seeing that it is nothing else than the vein which rises from the lungs, where it is divided into many branches mixed with the branches of the arterial vein, or rugged artery by which the air we breathe enters into ourselves, and a large artery emanating from the heart disperses its branches through the whole body. I should like the students to be carefully shewn the eleven small skins which, as so many shells, open and shut the four passages which these two caves contain; that is, the three hollow veins in the entrance, where they are so situated as in no way to hinder the flow of the blood which they contain into the right ventriculum of the heart though they carefully prevent it from escaping from it. The three arterial veins in the entrance situated in the contrary direction to the above permit the blood containing in that cavity to pass to the lungs, but they do not let the blood which is in the lungs return; likewise the two other veins in the mouth of the veined artery let the blood pass from the lungs to the left ventriculum of the heart but prevent its return; and the three great arteries in the entrance also let the blood pass from the heart but prevent its return there. It is not necessary to seek any other cause for the number of small skins than that the mouth of the veined artery being of an oval shape according to the place where it is, it can be conveniently shut up by two; while the others which are round can be better obstructed by three. Besides these I should like the students to see that the great artery and the arterial vein are of a much stronger and firmer constitution than the veined artery and the hollow vein; and that these two last are widened before they enter the heart and make there two small bags as it were, which are commonly called the ears of the heart and are made of flesh similar to itself. There is always greater heat in the heart than in any other part of the body, and lastly, this heat causes any small drop of blood that enters its cavities to be immediately swollen and widened as is the case with liquids in general when they dribble into any hot vessel.

After these observations it is not necessary that I should say anything further in regard to the explanation of the motion of the heart except that when its cavities are not full of blood, it

flows down there from the hollow vein to the right side, and from the veined artery to the left, because these two vessels are always full of blood, and their mouths which are towards the heart cannot be stopped up. But as soon as two drops of blood so enter there, that is in each cavity, seeing that they are necessarily very large, because the mouths through which they enter are large and the vessels from which they proceed are full of blood, the said two drops of blood are immediately rarified and expanded on account of the heat which they find there. From this fact they cause the whole heart to be swollen and at the same time strike and shut the five shells which are in the entrance of the vessels from which they emanate, and impede a large quantity of blood descending into the heart; and when they are more and more rarified, they at the same time strike and open the remaining six shells which are in the mouths of the two other vessels through which they issue; causing by this means all the arterial veins and the branches of the great artery to be swollen almost at the same moment as the heart; so that immediately afterwards, as even these arteries, the swelling abates, when the blood which enters it is cooled, and six of the shells are closed, and the five hollow veins and veined arteries are opened, and passage is thus made for two other drops of blood which again cause the heart and the arteries to swell as the previous drops had done. And because the blood which enters the heart in this manner, passes by the aforementioned ears of the heart, it follows that their motion is contrary to the motion of the heart, and when the heart is swollen, they abate.

But as those who do not know the force of mathematical demonstrations, and are not exercised in distinguishing truth from what is similar to truth, may venture to deny this without previously examining it; I desire to mention that the motion which I have now explained, so necessarily follows from the sole disposition of the organs which they can see with their own eyes, and from the heat which can be felt with their own fingers, also from the nature of the blood which is known by experience, in the same manner as the motion of a clock from the force,

position, and figure of the weights and wheels on which it depends.

But if it is asked why the blood of the veins so continually flowing down into the heart is not exhausted, and the arteries are not too full when all the blood which passes through them enters them; it is not necessary for me to make any other answer than that which is contained in a book written by a certain English physician to whom this praise should be

Harvey on the motion of the heart.

given that he it was that broke the first ice in this matter, and the first that taught us that there are many small ways in the extremities of the arteries, by which the blood which they receive from the heart passes into the small branches of the veins; from whence it again returns to the heart, so that its motion is nothing else than a certain perpetual circulation. This is the best proof from the ordinary experience of the surgeons, who, the middle of the arm being tied up with a ligature above the place where they want to open a vein, make the blood spring up more copiously than if they had not made the ligature. The contrary only happens if they make the ligature in the arm beneath, namely between the hand and the opening, or if the ligature be very tight. For it is manifest that the ligature in the middle of the arm can impede the blood which is then in the arm returning to the heart through the veins; but not indeed the incessant flow of the new blood into it from the arteries; because these arteries are collocated beneath the veins and their harder skin cannot be easily compressed, and because the blood issuing from the heart contends to pass by them with greater force to the hand than from thence to return to the heart by the veins. But since this blood passes from the arm by the opening made in one of the veins, there must necessarily be some passages beneath the ligature, that is about the extremity of the arm, by which it can come there from the arteries. What Harvey says regarding the motion of the blood most satisfactorily proves, from certain small skins situated in the various places of the shells like veins, that the said passages do not let the blood from the middle of the body to the extremities, but only permit it to return from the extre-

mities to the heart; besides this experience shews that all the blood which is in the body can in the shortest time pass from a single split artery, although it is most tightly tied up near the heart and split between itself and the tie; so that there can be no occasion for doubt that the issuing blood comes from any other place than the heart.

But there are many other facts which prove that, what I have stated is the true cause of the motion of the blood; first the difference between the blood which issues from the veins and that which emanates from the arteries; which can arise from no other cause than that it is rarified in its passage through the heart and distilled as it were, and thus becomes more subtle, more vivid and more warm as soon as it issues from thence, that is, when it is contained in the arteries than it was before it entered them, that is, when it is housed in the veins. If properly examined the said difference will not be clearly seen except in the vicinity of the heart, less indeed in places further removed from it. Then the hardness of the membranes of which the arterial vein and the great artery consist, sufficiently proves that the blood heats them with greater force than it heats the veins.

Why are also the left cavity of the heart and the great artery larger and wider than the right cavity and the arterial vein, unless the blood of the arterial vein having only entered the lungs from which it passes through the heart is more subtle, and is more and with greater facility rarified than the blood immediately preceding from the hollow vein? And what can the physicians conjecture from the feeling of the pulse, unless it be that they feel the blood, which as it changes its nature, is rarified by the warmth of the heart more or less, more speedily, or more tardily than before? And if it is considered how this said warmth is communicated to the members of the body, is it not to be admitted that this is effected by the help of the blood which issuing from the heart is heated there, and that it is thence dispersed through the whole body? From this it follows that if the blood is taken away from any part the warmth also subsides by the same means. And although the heart equals in heat red hot iron, it is not indeed sufficient to make

the feet and hands as warm as we feel them unless it continually sends new blood there. In the next place, from this it is also seen that the true use of respiration is the introduction of sufficient fresh air into the lungs for the purpose of making the blood which flows there from the right ventriculum of the heart, when rarified and changed as it were into vapours, thickened there, and again converted into blood before it flows to the left; as without this it will not be fit for keeping alive the fire which is there. This is confirmed by the fact that animals without lungs have only one ventriculum of the heart, and also by the fact that in infants which cannot use it so long as they lie shut up in the mother's womb, we see not only a certain hole by which the blood from the hollow vein flows into the left cavity of the heart, but also a short tube by which it passes from the arterial vein into the great artery without crossing the lung. Then how is digestion effected in the ventriculum unless the heart sends there heat together with certain more fluid parts of the blood, which help the bruising of the swallowed food? Does not also the action which converts the juice of the food into blood manifest itself easily if it is considered that the said juice is distilled entirely by repeated changes, perhaps more than a hundred times or two hundred times a day through the ventricles of the heart? And what else do we want for explaining the nutrition and the production of the various humours which are in the body, than to notice that the force by which the blood, while it is rarified, passes from the heart to the extremities of the arteries leaves some of its parts in the members to which they go occupying there the place of some parts which they drive from thence; and according to the site or figure, or the smallness of the pores which they strike, some of them rather than others melt into certain places; and this is done in the same manner as is done by certain sieves which from the single fact of their being diversely perforated subserve the purpose of mutually separating the various species of the grains from themselves. Lastly, that which above all merits our attention is the generation of the animal spirits which like the wind are the most subtle, or are rather like the purest flame which continually

ascending from the heart, in great abundance, to the head, thence penetrates by nerves into muscles, and gives motion to all the members; so that there is no necessity for imagining another cause making parts of blood which, because they are more agitated than others and are more penetrating, are the aptest for composing the said animal spirits, tend rather to the head than elsewhere, than that the arteries which convey them there proceed exactly in a right line from the heart; and, according to the rules of the mechanics, which are the same as the rules of nature, when various things simultaneously tend to the same point where there is no room for admitting them all, as happens in parts of blood, which issue from the right ventriculum of the heart, and tend to the head, it necessarily follows that the weaker and less agitated are thence turned aside by the stronger, which alone according to this view, arrive there.

I have explained all these things with sufficient particularity in the tractate which I once thought of publishing. In it consequently I shewed what must be the fabric of the human nerves and muscles in order that the animal spirits contained in them might have the force of moving the different members, since we see the heads even after they have been cut off from the trunks still moving and biting the earth although they are no longer animated; what changes need be made for producing wakefulness, sleep and sleeplessness; how light, sounds, smells, tastes, heat, and all the other qualities of the external objects impress in it their diverse ideas through the organs of the senses; how hunger, thirst, and other internal affections immit their ideas there; what is to be observed there where these ideas are received by the common sense, by the memory which preserves them, by the imagination which changes them in diverse ways and builds up new ones, and which, by also sending the animal spirits variously into the muscles, can effect in the members of the body all the same motions which are at any time produced in us without the authority of the will, and in the same manner as answer both to the external objects striking the organs of the senses, and to the external affections and temperaments. This will not appear strange to those who, seeing how the various

motions can be effected in automaton constructed by the industry of man, and that too by means of certain wheels and other instruments which are the fewest in number when compared with the infinite number of bones, muscles, nerves, arteries, veins, and other organic parts which are found in the body of every animal, consider the machine of human body, as it were, an automaton made by the hands of God, infinitely better regulated and containing more admirable motions than any which human art can produce. And here I particularly shewed that if such machines exist as are most similar in external figure, and all the organs to the monkey, or to any other brute animal, we shall by no means find them different from these creatures. But if there are some which resemble and imitate our actions so far as it can be done in a moral sense; we have always two most certain criterions left us for ascertaining that they are not therefore true men. The first is they will never have the use of speech, or of any signs which we use for communicating our thoughts to others. For, we can certainly conceive a machine so constructed as to pronounce some words, nay, also utter some which may correspond exactly to the presence of objects moving the external organs of the said machine; as if we touch it at a certain place, it may ask some thing if we wish it to do so; if touched at another place, it may cry out as if we struck it, and do other things of the same sort. But such a machine can never of its own motion collocate words for aptly responding to every thing that is uttered before it, in the same manner as men of the dullest intellect can do. The second is that although such machines may make many things equally as well as we do, or perhaps better than any of us, they will without doubt err in some others; and from this it may be inferred that they do not do things by the help of reason, but only from the peculiar disposition of their organs.* For, while reason is a universal instrument which can be of use on every occasion, these organs, on the contrary, want a certain peculiar disposition for every one of their actions; from this it follows that it is plainly incredible that a sufficiently large number of diverse organs can be found in any machine for the purpose of producing by their means only

all the external motions corresponding to the various accidents of life, in the same manner as they are produced in us by the help of reason. By means of these two criterions we can always ascertain the difference between man and beast. For it is worthy of observation that there are no men including even fools, so dull and stupid as not to be able to collocate diverse words and make a speech out of them for the purpose of communicating their thoughts to others. On the contrary, there is no other animal, whatever may be its perfection, and under whatsoever fortunate star it may be born, which can make any thing similar. And this does not happen from the defect of the organs; for we see magpies and parrots pronounce the same words as we do, although they cannot speak as we do, so as to shew that they understand what they articulate. Certain men although deaf and dumb from their birth, and so not less but rather more than the brutes destitute of the organs which enable others to speak, accustom themselves by means of their own industry to invent certain symbols by which they open their minds to those with whom they converse and who study their language. This indicates not only that the brutes have less reason, but that they are entirely destitute of it. For, we see that very little reason is requisite for speaking, and because we observe certain inequality of apprehension in the individuals of the same species, not less than among men, and that some faculties are more capacious in some than in others, it is incredible that the monkey or the parrot, the most perfect of its kind, cannot equal in this respect an infant the most stupid, or at least, only moved by mind, unless its life is of a nature plainly different from ours. We must note that speech and all the signs which from the nature of men denote thought differ much from the natural sounds and signs by which the affections of the body are indicated; nor ought we think, as some of our ancestors thought, that brutes speak, but that we do not understand their language. For, if this were true, seeing that they have many organs analogous to those which we have, they would make their mind known equally to us as they would to their own species. It is also worthy of particular note that

although there are many animals which exhibit greater industry than we do in some of their actions, the same animals are seen to shew none whatever in many others. So that, that which they do better than ourselves does not prove that they are endowed with reason; for, if it were so, it would follow that they have more reason than any of us, and that therefore they are superior to us also in everything else; so that this fact rather proves that they are destitute of reason, and that nature works in them according to the disposition of the organs; just as we see that a clock resting only on wheels and weights numbers hours and measures time more accurately than we can do with all our wisdom.

Afterwards, I described rational life, and shewed that it could in no way be evolved from the power of matter as other things about which I had already treated, and that it is necessarily created. Nor does it suffice that like sailors in a ship the rational life inhabits the body merely for the purpose of moving its members; it is tightly bound up and united with the body for the purpose of producing senses, and appetites, and thus making the true man. But here I have been a little more diffuse in my argument in treating of life as it is of the highest moment. For, besides the error of those who deny the existence of God, which I believe to have sufficiently refuted above, there is nothing which more easily turns weak minds from the right path of virtue than the fact that they believe the life of brutes to be of the same nature as that of ourselves; as if there was nothing for us to fear or hope beyond this life any more than for fleas and ants. If we rightly recognise the difference between ourselves and the brutes, we shall afterwards more easily comprehend the reasons which prove that our life is of a nature independant of the body, that, as a consequence, it follows that it is not necessary that it should die with the body, and, lastly, that because we see no causes which destroy life, we are forced by nature itself to affirm that it is immortal.

VI. This is the third year since I finished the tractate which contains all these things, and began to revise
 What, the author
 thinks, is required for it in order to commit it afterwards to the

the purpose of making a further progress in the examination of nature than has hitherto been made, and what reasons have induced him to write this tractate.

press ; when I learnt that persons for whom I have great respect, and whose authority is not of less influence in my actions than my own reason in influencing my thoughts, disapproved of a certain view in reference to physics, which was published by a certain person some time previously ; a view in which, not declaring myself to be a participator, I can say that there is nothing which before their censure, could be suspected as clashing with the interests either of religion or of common wealth, or would prevent my defending it if reason convinced me that it is true ; and this fact warned me to see whether any of my own opinions had erred from truth ; although I had always taken care not to express any new opinions which had not been confirmed by the most certain demonstrations, or which could in any way injure any person. This was indeed enough to make me desist from the resolution of publishing my opinions. Although the reasons which had induced me to publish my thoughts were the strongest, yet my mind which has always abhorred the idea of writing books has found many other reasons to excuse me from undertaking that task. And these reasons are, on either side, such that it is of importance not only to myself that I should here review them, but also perhaps to the republic of letters that it should know them.

I have never thought that my own productions are of any value, and, as long as I have reaped from the Method which I use, no other fruits than those which have satisfied me in clearing certain doubts relating to speculative sciences, or have endeavoured to adjust my own conduct according to the rules which it teaches me, I have not thought it necessary to write anything about it. For, as to what relates to conduct, everybody has his own senses so abundantly as to make as many reformers as there are heads, if others than those whom God has constituted the supreme rulers of his people, or whom he has endowed with such a sufficiently large measure of his grace or favour as to make them prophets, are allowed to undertake something immutable or heavenly in that respect.

And although my own speculations please me highly, I believe others also have theirs which perhaps please them yet more. But as soon as I had conceived certain general notions relating to the physical science, and, beginning to make a trial of them in various important questions, observed how far they could take me, and how much they differed from the principles which have been hitherto in use, I believed that I ought not to retain them as secrets without gravely offending against the law which enjoins that as far as we are able we should contribute to the common weal. From the said experiments I have obtained knowledge really useful in life, and have learnt to find what is practical in the place of that speculative philosophy which is taught in the academies; by means of which, after comprehending the forces and actions of fire, water, air, the stars, and other heavenly bodies which surround us, as distinctly as we know the arts of the diverse operatives, we shall be able to apply such knowledge to all uses to which it can be applied; and thus to make ourselves lords and possessors of nature. This state of things is to be desired not only for the purpose of inventing an infinite number of artifices which will enable us to enjoy without labour the fruits of the earth, and all its conveniences, but also for the purpose of preserving health which without doubt is the first boon of this life, and the foundation of all others. The mind depends so much on the temperament and disposition of the organs of the body, that if any means can be found which can make men more intelligent and more ingenious than they are at present, I believe it is to be sought only in the science of medicine which at present contains only a few things whose utility is extraordinary. But, though I can by no means bring my mind to undervalue the present science of medicine, I believe there is none among those who profess it who will not admit that all that has been as yet discovered in it is as nothing when compared with what yet remains to be discovered, seeing that men are to be freed from the infinite variety of distempers both of the body and mind, nay, also perhaps from the infirmity of age, if we have a sufficiently extensive knowledge of the causes from which such distempers arise, and

of all the remedies which nature prescribes. When I determined to spend all my life in the investigation of so necessary a science, and fell in such a way as would, if anybody followed it, lead to the desired end, unless prevented by the shortness of life or defects of experiments, I thought that there was no better remedy against these two evils than to communicate faithfully to the public all that, however little it might be, which I had discovered, and to induce bright intellects to proceed further, and to incite each to submit to experiment whatever was within his own knowledge, and to make the public participator of whatever he knew; in order that their successors might begin where they had left; and thus joining the lives and labours of many, all of us might progress further than single individuals privately could.

With regard to experiments, I have observed that their necessity becomes greater in proportion as our knowledge advances. At the beginning we use only such knowledge as spontaneously occurs to our senses, such knowledge as we cannot possibly ignore, even if we pay to it very much less attention than that with which we investigate the rarer and the more abstruse. The reason of it is this, the rarer often escape us as long as the causes of the more common are ignored; also the circumstances upon which they depend are almost always so exact and so small as are most difficult to be observed. But I have in this matter followed this order; first, I have endeavoured to find generally the principles, or the first causes of all which are, or can be in the Universe, regard being had to God who has created it, and deducing the said causes not otherwise than from certain seeds which are planted in our minds by nature herself. Afterwards, I have considered what are the first and most ordinary effects which could be deduced from these causes; and by these means I have come to the knowledge of the heavens, stars, earth, also water on the earth, air, fire, minerals, and certain other things of the same nature, which are the most common of all, and the most simple, and therefore the most easy to be known. Then, when I wished to descend to particulars, so many diverse things occurred as to require more than human mind for the purpose

of distinguishing the forms or species of the bodies which are on the earth from infinite others which can be there if it is God's pleasure to collocate them there, and lastly for the purpose of reducing them to our use; unless by means of effects we reach obvious causes, and are assisted by many experiments. Then again, revolving in my mind all objects which at any time occur to my senses, I am able to assert that I observe nothing in them which cannot be explained well enough by means of the principles which I have invented. But I must admit that the power of nature is so great and ambagious, and my principles are so simple and general that I am unable to observe any great particular effect which I cannot immediately distinguish in various ways by means of the said principles; yet nothing ordinarily appears to me to be more difficult than to discover on which of the various ways the said particular effect depends. From this difficulty one cannot extricate one's self, otherwise than by again resorting to other experiments producing different results, in order to see if an explanation can be obtained by this than by the other mode. But I have now so far advanced that I can perceive well enough how the most of these experiments are to be made, which can subserve this end. And I also see that they are such and so manifold as neither my means, nor my fortune, even if both were a thousand times more than they are, can suffice for making them all; in proportion as the means of making the experiments are greater or smaller, our progress in the knowledge of nature will be more or less. What I said in the tractate which I have written, and what I there made clear was that the public in general would be so benefited by this, that all those who were interested in the general welfare of mankind, that is, all who were really, and not speciously honest men ought to be induced to communicate to me the experiments which they had already made, and assist me in the investigation of those which were yet to be made.

But since then other considerations have altered my mind, and induced me to commit to writing everything in which I think there is any thing of moment as soon as I am certain of its truth, not indeed with less care than if I were to

publish it, both because I should then have greater occasion for properly examining it, seeing that, without doubt, greater care is bestowed upon a composition which is believed to be read by many than upon that which is written only for private use, and also seeing that things which appear to me as true when I first conceive them, afterwards appear to be false when I wish to commit them to paper; and also because I should omit no opportunity of procuring public good as far as it lies in my power; and that, if my writings are of any value, they in whose hands they may fall after my death, may use them as to them may appear proper. But my resolution is that my writings should never see light during my life-time, lest either the oppositions and controversies to which they may be exposed, or whatever fame they may be able to achieve for me, may deprive me of the leisure which I am determined to apply to my system. For, although it may be true that every one ought, as far as he can, to contribute to the public good, and that he is properly speaking of no value whatever who is of no use to anybody, it is also true that our cares should extend beyond the present times, and that it is right to forego that which will bring little good to the present generation, in order that we may achieve that which will produce greater advantage to the succeeding generations. Thus I do not wish to conceal that it is very little which I now know compared with that which still remains to be known, and which I have every hope of knowing. This is almost the case with those who slowly discover some truth in sciences, as with those who are getting enriched, who can more easily make greater gains than they could make much smaller ones before when they were as yet poor. Or, they may be compared with the generals of armies whose influence increases according to the number of victories which they have achieved, and to whom after suffering the slaughter of a defeat, greater caution is necessary for the purpose of preserving the remainder of their forces than when they were victorious, and took cities and provinces. For he really sees in battle who endeavours to surmount all difficulties, and avoid errors, what the obstacles are for arriving at the knowledge of truth; and he is overcome in battle who has a

false estimation of any matter of moment, and has, afterwards, need of greater skill to restore himself to his previous position than for making great progresses, when he has already certain principles. As for myself, if I have discovered any truths in the sciences, (as I hope those which are contained in this volume will shew that I have made some), I can only say that they are the results of five or six difficult questions which I have solved, and which I reckon as so many battles in which I have gained victories. Nay, I do not hesitate to assert that there is nothing which I want more for the purpose of gaining my end than to make two or more like victories; and that I am not as yet so old, but according to the ordinary course of nature, I have time enough yet left for me to achieve this. But I know that I must be as much more sparing of the time which yet remains for me, as I hope to spend it well. Doubtless I might have many occasions for losing my leisure if I were to publish the rudiments of my physics. Although I see that almost all of them are so evident as to be assented to if they are only comprehended, there is nothing whose demonstrations I cannot give; but because it cannot be expected that they will fall in with the various opinions of all others, I foresee that I shall have to desist from publishing my work by reason of the oppositions which it may excite.

It may be said that such oppositions are of use, as, while by their means I might see my own errors, on the other hand if there were anything worth knowing in my work, others might follow it up better in this manner; and because many eyes see much more than one eye can, they may, using my own knowledge, help me in their turn with their own. But though I admit I am obnoxious to error, and generally never trust to my first thoughts, yet the experience which I have of the objections made to me, inspires me with no hope of my deriving any fruit from them. For, I am aware of the discernment both of those whom I regard as my friends, and of certain other persons who treat me with indifference; as well as of some who are malignant and invidious, who I know would drag into broad day light that which the veil of friendship conceals from the eyes of

friends. But it rarely happens that any objection is taken in my case against which I am not already provided, unless it is an objection which is entirely unconnected with my theme ; so that generally I offend no censor of my opinions who does not appear to me less rigid or less just than I am to myself. Thus also, I have never seen that any truth before unknown has been brought to light by means of scholastic disputations. For, while every one contends for victory, he is for the most part inclined to attend to what is similar to truth than to the importance of the reasons adduced on both sides ; and those who have long been good advocates are not therefore afterwards better judges.

As for the help which others will derive from the communication of my meditations, it cannot be very great because they are not as yet so far advanced as to require no supplement to them before they are reduced to practice ; and I think I can say without boast that if there be anybody who is capable of perfecting them, it is rather I myself than anybody else. I do not say that there are in the world no intellects which are much superior to me ; all that I mean is this, that he cannot so well conceive a thing and make it his own who learns it from another, as he who himself discovers it. This is so true in this matter that, although I have always explained some of my views to the most acute men who, during my explanation seemed to understand them very distinctly, yet when they reported them, they so changed them as to make me unable to recognise them as any longer mine. I therefore ask the posterity not to regard anything as mine which I myself have not published. And I by no means wonder at those dogmas which are attributed to those ancient philosophers whose writings we do not possess ; nor therefore do I regard their thoughts to have been so far removed from reason, seeing that they were the foremost intellects of their ages ; my impression being that tradition has not accurately delivered them to us. Thus, we also see that it has almost never happened that they have been excelled by any of their followers ; and I believe that the most ardent of those who follow Aristotle think themselves blessed if they equal him in the knowledge of nature, as they learn nothing more after-

wards. In this they resemble the ivy which does not strive to rise higher than the trees which sustain it; nay, it always descends after it has reached the top. To me they appear to descend, that is, by some means to make themselves more unlearned than if they desisted from study; who not content to study everything which their author has clearly and lucidly explained, seek to find from him the solution of many difficult questions of which not a word is said by him, and which he perhaps never knew. But this mode of philosophising is suitable to intellects which are below mediocrity, for the obscurity of the distinctions and principles which they employ is the cause of the audacity of their speaking of everything with equal confidence as if they knew it well enough; so to defend against the most subtle and the most acute everything which they assert, as not to be liable to the accusation of being false. In this they appear to me to resemble a blind man who, that he may fight under equal conditions on both sides, brings his opponent whose sight is perfect into some deep and dark cell. I may say that it is the interest of such men that I should abstain from publishing the principles of the philosophy which I employ; for as my principles are the most simple and evident, I should do the same thing by furnishing this light, as if I opened some windows by which I might let the light into the cell into which the aforesaid opponents descended for fighting. Indeed, they are not men of bright intellects to desire to understand them. For, if they wish to know to speak about all, and acquire to themselves the fame of erudition, they will more easily obtain their end by being content with what is similar to truth, as this can be done without great labour in every kind of matter, than if they want to investigate its real truth which will reveal itself only slowly in certain matters; while about others they will be driven to a frank confession of their ignorance. If they prefer the knowledge of a few truths to the vain profession of knowing all, as doubtless it is preferable, and follow my rules, I need say nothing further than what I have stated in this Dissertation. For, if they be capable of making greater progress than I have made, they must be men of much stronger reasoning faculty for discovering by their own abilities

all which I believe to have hitherto discovered, because, though I have examined everything in its order, it is certain that what still remains for me to drag out of darkness will by itself be more difficult and abstruse than that which I have been already able to discover; and much less will be the pleasure to them to learn this from me than from themselves. Besides, the habit which they ought to acquire of investigating the easier first and proceeding little by little and gradually to the other more difficult questions, will profit more than all my lessons. As to what appertains to me, if in my youth I had learnt all the truths whose demonstrations I sought afterwards, and learnt them without labour, I think that I should perhaps not have known many; at least, I should never have acquired the habit and facility by which I hope always to discover new truths, according as I apply my mind for investigating them. And, in a word, if there is in the world any work which cannot be so well executed by any except by the person who began it, it is that in which I am engaged, and in which I labour.

It is certainly true so far as experiments are concerned, which subserve this purpose, that no one man is equal to the work of making them all. But at the same time it is also true that no other hands can be applied to this work except those of the operatives, or other like mercenaries whom the hope of gain—a means of great efficacy—may induce to make accurately such experiments as may be prescribed to them. For, as to what relates to amateurs who, urged either by curiosity or desire to learn, perhaps spontaneously, offer their services, besides promising much and doing little, none of their undertakings have ever reached the desired end; without doubt they desire that their labours should be compensated by the solution of some difficult questions, or, at least, by vapid compliments and addresses in which no scientist can indulge to spend a part of his leisure without great detriment. And referring to experiments which others have already made, although they may desire to communicate them to the scientist, which those will never do who keep them as secrets; they are for the most part accompanied by so many circumstances and such super-

fluens matter as to make it most difficult to him to elicit any truth from them. Besides this, he will find almost every thing badly explained, or even false, (because those who make them only want to see in them only those things which they consider as conformable to their own principles), that even if some were to answer his purpose, they will not equal the value of time which is to be spent in making a selection from them. So that if there is anybody in the world who is capable of making the greatest, and, to the public, most useful discoveries, and if in this cause everybody else tries to assist him by following up his purpose, I do not think that he can do anything else to favour him than to put himself to the expense of making experiments, and to prevent the scientist's time being wasted by anybody's importunity. Besides not arrogating to myself so much as to promise some thing extraordinary, nor feeding myself with vain thoughts by supposing that the general republic ought to respect my counsels much, I am at the same time not of so abject a mind as to desire to receive from anybody a benefit of which, it may be said, I am unworthy.

All these considerations put together shew the cause of my not having published the tractate which I have had ready for the last three years; nay, of my having resolved not to publish during my life-time any other book which would be altogether general, or from which the rudiments of my physics might be comprehended. But afterwards two other causes induced me to subjoin some definite instances, and give to the public some explanation of my actions and reasons. The first of these is that if I were not to publish it, many who knew my previous resolution of publishing some of my writings would suspect that the considerations which induced me to abstain from it were not as honorable as they really were. For although I do not seek glory particularly, or even, if I may say so, abhor it so far as I deem it to be opposed to my quietness which I value above all; yet I have never made an attempt to conceal my works as if they were crimes, or adopted any other precautions to remain myself unknown, because it would be injurious to me, which would again be adverse to the perfect peace of my mind which I was

seeking. And because, while I was thus indifferent to remaining unknown, or to being concealed, I could not prevent myself from being somewhat the subject of talk among men, I thought that I ought to take some pains at least not to merit censure. The other reason which has induced me to write this is this, seeing that my resolution of informing myself suffers more delay every day from want of infinite experiments which I need, and which I cannot make without extraneous assistance,—although I am not so much a Suffenus as to wish the public to take my part,—I do not wish to be so wanting to myself as to give occasion to the posterity of sometimes censuring me that I might have left them various better things than I had done, had I not neglected to signify to them in what matter they might improve my system.

And I have thought it easy for me to select matters which are neither exposed to many controversies, nor compel me to have recourse to more principles for their explanation than mine; and which yet clearly shew what I can promise in the sciences, and what not. Whether I have succeeded in this I leave it to others to judge; and it will be very grateful to me if they are examined; and, that there may be a greater facility for this, I ask all those who wish to make objections against them to send them to my bookseller, as communicating with him I will endeavour to subjoin my answer at the same time; in order that my readers reading both at the same time, may with greater facility judge of the truth. I will not promise to make prolix answers to them, but only to admit my errors candidly if I recognise them as such, or if I am not able to see them, simply to say what is necessary to be said in defence of what I have written, without adding explanation of any new matter, as then I may have to pass from one matter to another without end.

If any thing which I have said in the beginning of my *Dioptrics* and *Meteorology* offend at the first sight, because I call it a hypothesis, and do not prove it; I ask that the two tractates may be read thoroughly with attention, as I hope that then the doubts of the doubters may be thus satisfied. For reasons in them appear to me to be connected in such a series that the last are

demonstrated by the first which are their causes, so that reciprocally the first are proved by the last which are their effects. Nor is there anything about which anybody may say that I fall into the fault of what the logicians call reasoning in a circle; for when experience proves that the greatest part of these effects is true, the causes from which I deduce them serve not so much to prove as to explain them; and on the other hand, these are proved by those. Nor do I call them hypotheses with any other object than to signify that I am able to deduce them from those prime truths which I have explained above; but I have purposely avoided so deducing them in order to prevent certain intellects which think that they can learn in a day those things in which another person has laboured for twenty years, as soon as I have explained them to them in one way or in another, (and which are so much more prone to error and less capacious of apprehending the truth in proportion as they are more subtle or more active); thence seizing the occasion of constructing some absurd philosophy upon principles which they hold as mine, the blame of it falling to me. For as to the opinions which are solidly mine, I do not wish to excuse myself on account of their novelty; because if the reasons on which they rest are properly weighed, I believe they will be found to be so simple and so conformable to common sense, that they will appear less extraordinary and less paradoxical than any others which can be elicited from the same arguments. Nor do I boast that I am the first that have discovered any truths, but I only say that I have not adopted them as mine, either because they had been adopted by others, or because they had not been so adopted; but only on account of this simple fact that reason has persuaded me to adopt them.

If workmen cannot at once reduce to practice the discovery explained in the Dioptrics, I do not believe that it can therefore be deservedly condemned. For great dexterity and training are required for making the machines which I have described, and so fitting them as no circumstance may be wanting; nor shall I wonder the less if they succeed in the very first experiment, than if anybody could learn in one day to play exquisitely.

sitely on the lute, if only the best mode of playing is described to him.

But I do not wish to say here anything specially regarding the progresses which I henceforward hope to make in sciences, or to bind myself by any promises to the public which I am uncertain whether I can fulfil or not. I may however only say that I have resolved to use the remaining part of my life not otherwise than in acquiring that knowledge of nature from which more certain rules may be deduced in the science of medicine than those which are at present in use. My mind so abhors every other kind of pursuit, chiefly that which does not profit some unless it harms others; that, if on any occasion I am forced to follow such a pursuit, I do not think that I can achieve anything great in it. This I here openly declare, although I know that such a declaration is of no use for acquiring me either influence or esteem, as I affect neither so as to think myself always to be bound to them by whose favour I may be permitted to enjoy my leisure without obstruction, any more than to those who may offer me the highest honors.

FINIS.

